

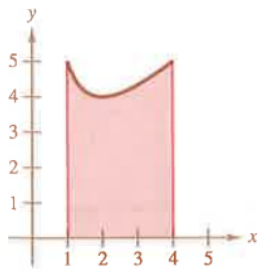
Calculus Warm Up # 8-3

When an object is removed from a furnace and placed in an environment with a constant temperature of 90° , its core temperature is 1500° . One hour later its core temperature is 1120° . Find the core temperature 5 hours after it is removed from the furnace.

HW Questions: 7.6, p.399

37. $y = \frac{x^2 + 4}{x}$

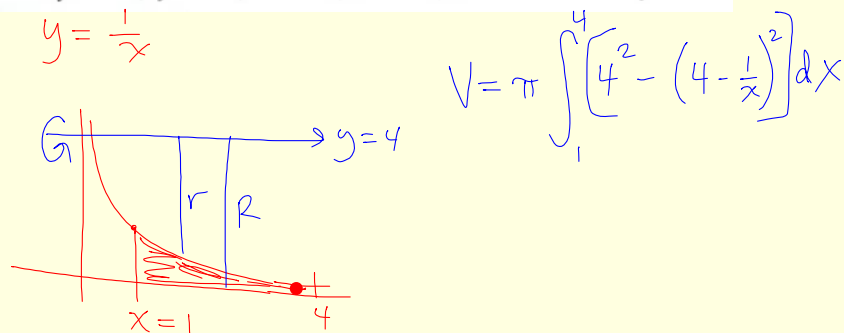
find area



In Exercises 39–42, find the volume of the solid generated by revolving the region bounded by the graphs of the given equations about the indicated axis.

39. $y = \frac{1}{\sqrt{x+1}}$, $y = 0$, $x = 0$, $x = 3$, about the x -axis

41. $xy = 1$, $y = 0$, $x = 1$, $x = 4$, about the line $y = 4$



43. Find the area of the region bounded by the graphs of $y = 3^x$, $y = 0$, $x = 0$, and $x = 3$.

In Exercises 45 and 46, find the work done by the gas for the given volumes and pressures. Assume the pressure is inversely proportional to the volume. (Use Exam-

- 45.** A quantity of gas with an initial volume of 2 cubic feet and an initial pressure of 1000 pounds per square foot expands to a volume of 3 cubic feet.

$$P = \frac{k}{V}, V_0 = 2 \text{ ft}^3$$

$$V_1 = 3 \text{ ft}^3$$

$$P_0 = 1000$$

$$W = \int_{V_0}^{V_1} \frac{k}{V} dV$$

$$2000 \int_2^3 \frac{1}{V} dV$$

$$1000 = \frac{k}{2}$$

$$2000 = k$$

7.7 p. 404

9. Find r , time to double and amount after 25 yrs.

Initial investment = \$500, \$1292.85 after 10 yrs.

<u>Isotope</u>	<u>Half-life (in yrs)</u>	<u>Initial quantity</u>	<u>Amount after 1,000 yrs</u>	<u>Amount after 10,000 yrs</u>
19. Ra ²²⁶	1,620	10 grams		
21. C ¹⁴	5,730			2 grams

$$\frac{1}{2} = e^{k(5730)}$$

$$\frac{\ln(0.5)}{5730} = \frac{k(5730)}{5730}$$

29. Using Newton's Law of Cooling (see Example 5), determine the reading on a thermometer 5 minutes after it is taken from a room at 72° Fahrenheit to the outdoors where the temperature is 20°, if the reading dropped to 48° after 1 minute.

given (t, y) →

$$\frac{dy}{dt} = k(y - T)$$

Separation of Variables

- 1) Separate
- 2) Integrate
- 3) Find C
- 4) Find k
- 5) Find what answers the question

30. An object in a room at 70° cools from 350° to 150° in 45 minutes. Using Newton's Law of Cooling, find the time necessary for the object to cool to 80° .

$$\frac{dy}{dt} = k(y - 70)$$

$$\int \frac{1}{y-70} dy = \int k dt$$

$$\ln(y - 70) = kt + C$$

$$\ln(280) = C$$

$$(0, 350)$$

$$(45, 150)$$

$$t = ? \quad y = 80$$

answer #30)

$$\approx 119.7 \text{ minutes}$$

31. Using Newton's Law of Cooling, determine the outdoor temperature if a thermometer is taken from a room where the temperature is 68° to the outdoors, where after $\frac{1}{2}$ minute and 1 minute the thermometer reads 53° and 42° , respectively.

$$(0, 68)$$

$$\int \frac{1}{y-T} dy = \int k dt$$

$$(.5, 53)$$

$$\ln(y - T) = kt + C$$

$$(1, 42)$$

$$\ln(68 - T) = C$$

$$\text{find } k \rightarrow \ln(53 - T) = k(0.5) + \ln(68 - T)$$

$$2 \ln\left(\frac{53 - T}{68 - T}\right) = k$$


Chapter 7 Review

7.2 Integration of Exponential Functions

7.6 Integration of Logarithmic Functions

7.7 Newton's Law of Cooling and Separation of Variables.

Another look at integration when the base is not e.

$$\begin{aligned}
 \int 5^x dx &\longrightarrow 5^x = (e^{\ln 5})^x \\
 &= e^{(\ln 5)x} \\
 &= \int e^{(\ln 5)x} dx \longrightarrow \text{let } u = (\ln 5)x \\
 &\quad du = (\ln 5) dx \\
 &= \frac{1}{\ln 5} \int (\ln 5) e^{(\ln 5)x} dx \longrightarrow \frac{1}{\ln 5} \int (\ln 5) 5^x dx \\
 &= \frac{1}{\ln 5} \int e^u du \\
 &= \frac{1}{\ln 5} \cdot e^{(\ln 5)x} + C \\
 &= \frac{5^x}{\ln 5} + C
 \end{aligned}$$


Classwork Ch. 7 review

Name:

Evaluate the integral

1. $\int \frac{x}{x^2 - 1} dx$

2. $\int \frac{\ln \sqrt{x}}{x} dx$

3. $\int \frac{x^3 + 1}{x^2} dx$

4. $\int \left(x + \frac{1}{x}\right)^2 dx$

5. $\int \frac{x + 2}{2x + 3} dx$

6. $\int \frac{e^{1/x}}{x^2} dx$

7. $\int \frac{e^{2x} - e^{-2x}}{e^{2x} + e^{-2x}} dx$

8. $\int x^2 e^{x^3+1} dx$

9. $\int \frac{x - 1}{3x^2 - 6x - 1} dx$

HW: Ch. 7 review

p. 415, # 39 - 65 odd

Friday: Group Event

Ch. 7 Applications
(counts as classwork)